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Title

Optical design of the SIM System Testbed 3

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Presentation: Oral presentation

Abstract

The SIM System Testbed 3 (STB-3) is a 3-baseline interferometer mounted on a full scale SIM-like flexible structure, developed at JPL under the Interferometry Technology Program. The goal of the testbed is to demonstrate angle and pathlength tracking of a dim science star by feeding forward information from two interferometers looking at bright guide stars. This paper presents the optical architecture of STB-3 and the first results obtained with the 3 interferometers.

The testbed consists of two separate systems isolated from the ground: the pseudo-star and the instrument itself.

The pseudo-star is a passive reverse interferometer on a rigid table that produces three artificial stars located at 15 degrees from each other. A white light source coupled with a Nd:Yag laser produces the simulated stellar wavefront. The main novelty of the design is the use of two pairs of diffraction gratings to split the stellar wavefront into 3 (or more) stars. These gratings minimize the differential position jitter of each star with respect to the others, reducing overall error in the experiment. The science star is simulated in white light, whereas the two others are laser stars.

The instrument is a triple Michelson interferometer on a structure. One interferometer is defined as the "Science" baseline whereas the two others are called "Guide" baselines. Each interferometer runs a CCD camera and two fast steering mirrors for angle tracking and an Avalanche Photo-Diode and active optical delay-lines for fringe tracking. An internal heterodyne laser metrology

sensor monitors the instrument optical path and controls the position of the delay line. An external laser metrology sensor measures the size of the common baseline.

Key words

interferometry, optics, pseudo-star

Biography

Renaud Goullioud is an optical engineer. He has an engineering degree in electronics from the Institute of Chemistry and Physics of Lyon (France) and a Ph. D. in micro-electronics. He has been working at JPL in the Interferometry Technology Program since 1997.